00/05/54

PROGRESS REPORT
FOR
JULY 1954
ON
FOUR INCH ROCKET

Trip Report of Conference on Four Inch Rocket on 15 July 1954:

The memo of 13 July 1954 to the contractor on provisions for variable range and variable time delay was presented to the client's representative. The various proposals contained in this memo were the main subject of this discussion.

Proposal of making five different motor tubes was considered impractical because of the additional materials and equipment which would have to be carried to the launching site.

The proposal of one motor with increments to be removed for the different ranges was considered to be fundamentally the best design from an operational standpoint.

The single motor to be assembled by the operator was considered to be feasible though it was felt that, if possible, it was more desirable to have the thing completely assembled except for time delays and have the operator remove and destroy powder increments rather than assemble these increments.

The client's representative pointed out that the operators would be persons of better than average intelligence with better than average finger dexterity, who would be somewhat skilled in many of the arts so that we could be dependent upon them to follow relatively simple directions with precision and accuracy, thus the design would not have to be overly simplified and made entirely foolproof as far as its assembly and disassembly were concerned. NOT TRUE

Feasibility of making a single motor having one single motor tube was discussed. This motor tube to contain five powder increments all being used for the longest range, successive increments being removed for each reduction in range. This would necessitate either five nozzle plates or a dial-a-nozzle plate, or the insertion of five different sets of nozzles into a blank plate. This, together with five sets of time delays for the five different ranges would result in a completed but usable system.

It was pointed out during this discussion, that it was most desirable that the store be made in one piece and the motor made in a second piece so that each could be carried under a coat without detection. It was also considered desirable, if possible, to so design the store carrying portion of the rocket that it would be possible to carry 22 ounces of payload. Fifteen hundred individual items would be the equivalent.

The possibility of having a multi-tube motor having minimum of 15 tubes was discussed, each one containing a propellant grain which would be removed in units of three for each decrease in range. Each tube would have its own nozzle, thus it would not require the operator to change nozzles and thus would avoid the leakage which would occur with a dial-a-nozzle plate.

For a launching tube, we should consider a paper tube similar to that used by the Army for their T122 rocket. This launcher should be so adjusted that it can be operated in general at a fixed angle with adjustment over a few mils to take care of temperature effects, etc. We would be required as a part of this contract, in the third phase, to provide firing tables for this device.

It is contemplated that the first phase should be completed in 5-1/2 to 6 months and a report be in by 1 December 1954.

At this time, the question of reports came up. It is the client's desire that we supply complete engineering reports at the end of each phase. These would be in binders bearing our name so that there would be no question of identifying the source of work at some future date. He does not believe it desirable in these reports that we remain anonymous, nor that we be so vague about the details that they would be unable to duplicate the item and its performance at some later period. Where linens are needed, he will supply them upon our request.

Monthly reports should be of such nature as to keep him informed, as to our progress and the probability of successful completion of that portion of the task, as well as be kept up to date on our thinking and direction of effort.

In the firing of this device, it is essential that it may be initiated by a time delay so that the operator may be entirely away from the vicinity of the launcher at the time the rocket is launched. We should also give serious thought to a second delay mechanism which could initiate a demolition charge to completely destroy the launcher after the rocket is launched.

He said he understood that we have a high speed camera and he thought it most desirable that pictures be taken of the flight testing of these devices and should be included in the report.

Progress Report on the Four Inch Rocket:

Upon receipt of the contract on 25 June 1954 for the development of a Special Rocket to be used in delivering leaflets between

ranges of 500 yards and 2500 yards, preliminary discussions were held for the purpose of developing possible lines of approach.

Since exact requirements for this unit were not yet available, many possibilities were discussed regarding size, shape, method of launching, power plant, materials for construction, etc. It was known at the outset of this program that certain requirements contained in the proposal, which was accepted by the client, would have to be fulfilled. Among these were:

(1) Economical to produce
(2) Relatively small, i.e., portable
(3) Constructed of materials which can be destroyed by a burster charge
(4) Five ranges of 500, 1000, 1500, 2000 and 2500 yards
(5) Capable of being loaded in the field
(6) Waterproof packaged
(7) Accuracy of ± 75 feet at the specified ranges
(8) Should burst and shower leaflets between 200 and 100 feet above the ground
(9) Fired from a fixed angle of about 45°
(10) Metal parts kept to a minimum, due to hazards of fragmentation.

All discussions held were directed toward the fulfillment of these primary requirements. Out of these discussions came three feasible methods of approach. These approaches can be listed briefly in the following manner:

(1) One vehicle with five separate attachable and detachable motors for the five ranges, or essentially five separate rockets, each with its own time delay which could power individually a single leaflet carrying section.
(2) One unit with multiple motor tubes which could be removed or added in the field depending upon range, with five different time delays.
(3) One unit with five different propellant charges and five separate nozzle plates which would accommodate five ranges, in addition to five attachable time delays.

It was generally agreed that Method No. 1 stood the best chance of succeeding. Method No. 2 would be most difficult to accomplish and Method No. 3 would stand a good chance of success, although not as promising as Method No. 1.

Lists of possible advantages and disadvantages were prepared for all three methods and presented to the client by our representative.

It may be noted in the trip report that the client favored, as a first choice, Method No. 2 which consisted of one unit with multiple motor tubes which could be removed or added in the field depending upon range, with five different time delays, and as a second choice, Method No. 3 which consisted of a single motor tube with incremented propellant charges which could be changed in the field. Subsequently, our efforts were directed toward the development of units of these types. } NOT TRUE

Preliminary work on the development of this unit involved a selection of materials which would most nearly conform to known requirements. It was hoped that most of the major components could be fabricated from plastic, paper, wood, or synthetic materials, keeping the use of metallic parts to an absolute minimum.

It is anticipated that this unit will consist of the following major components:

(1) Ogive
(2) Body
(3) Burster Tube Assembly
(4) Time Delay Mechanism
(5) Rocket Motor with Propellant

Of the above listed components, it is believed that only the mechanical time fuse would involve the use of metallic materials. Actual testing of a number of likely materials will determine whether or not the motor and nozzles can be made of materials other than metal. It is considered possible that such materials as masonite, plastic, or formica can be satisfactorily used in the rocket motor.

Early in the investigation of materials for the construction of a motor tube, it became apparent that the use of a single motor tube of non-metallic materials was impracticable because if made of the strongest reinforced plastic would require a wall thickness of about one inch. Based on this factor, it was decided that multiple small motor tubes were essential. This change in design eliminated the possibility of using "carpet roll" as the propellant charge.

Several models of the ogive have been fabricated from a polyester resin, reinforced with glass cloth and glass matting which show evidence of being satisfactory for use in this unit.

The burster tube assembly and the body of the unit which houses the payload can, in all probability, be made from wood, paper and twine. This would be very desirable from the standpoint of fragmenting the unit, since similar materials were successfully

used in the development of the special leaflet mortar. It is possible that due to centrifugal forces developed by the spin of the missile, these components may require a greater hoop strength than can be attained from the materials mentioned. In that event, a material such as formica, which has a higher hoop strength, but fragments well, may be required.

Calculations for the probable time of flight of the missile and the velocities involved have made it quite apparent that the time delay fuse must have a high degree of accuracy. It is considered doubtful that a pyrotechnic time delay composition would match the accuracy of a mechanical time fuze. This factor together with the convenience of setting a mechanical fuse lead to our efforts to locate a mechanical time fuse which will give the needed accuracy and at the same time will withstand centrifugal and setback forces to be encountered. The George W. Borg Corporation of Delavan, Wisconsin, presently manufactures a time delay device believed suitable for this purpose.

Preliminary calculations have been made with regard to the amount of propellant powder required for the various ranges. It is planned to use existing types of propellants such as M-7, JPN, or N-4 powders because of their availability and known performance.

Preliminary motors and nozzles have been designed. Since this unit must be of such nature that individual propellant charges can be removed individually in the field, study has been given to the arrangement of the multiple motor. It appears that symmetrical arrangement of fifteen motor tubes is required.

Work is progressing on the fabrication of a prototype model of this unit which can be static tested in order to determine which materials show greatest promise for use in the development of this item. To date, plastic ogives, plastic nozzles and formica motor tubes have been fabricated. These components will be tested statically as soon as required instrumentation has been set up for conducting such tests.

Future Work Planned:

Work outlined in previous paragraphs such as selection of materials, static testing, fabrication of prototype components, etc., will be carried forward as rapidly as materials can be obtained and instrumentation set up.

Financial Statement:

50X1

Total Amount of Contract	[redacted]
Expenditures for July 1954	
Total Expenditures to 31 July 1954	
Balance of Contract	